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Purpose/Objective: Here we report the prospectively documented short- and long-term health-related quality of life (HRQoL) of a large cohort of patients with advanced laryngeal cancer. The patients were treated in a randomized trial comparing accelerated radiotherapy with carbogen and nicotinamide (ARCON) against accelerated radiotherapy alone (AR).

Materials and Methods: Of 345 patients with cT2-4 laryngeal cancer, 174 were randomly assigned to AR and 171 to ARCON. HRQoL was assessed using the European Organisation for Research and Treatment of Cancer (EORTC) QoL Questionnaire-C30 (QLQ-C30) and the Head&Neck cancer module (QLQ-H&N35) at baseline, at completion of radiotherapy and at 6, 12, and 24 months post-baseline. Tumor- and patient related factors with potential impact on quality of speech and swallowing were analyzed separately. Data were analyzed two years after inclusion of the last patient.

Results: Compliance with completion of questionnaires at different time-points was high (AR: 60-79%; ARCON 70-81%). Significant clinical impact (>10 effect-points) was observed for nearly all items of the QLQ-C30 and QLQ-H&N35 between baseline and end of treatment. At 6 months, scores returned to baseline level for all items with exception of dry mouth, sticky saliva, taste- and smell perception. No difference in HRQoL score between AR and ARCON was observed at any of the time points. The rate of patients reporting 'quite a bit' or 'very much' complaints of dry mouth, sticky saliva, or changes in taste- and smell perception for AR vs ARCON is limited to 26% vs 33%, 20% vs 23% and 20% vs 17% at 2 years, respectively. At 2 years from diagnosis, the majority of patients treated by AR vs ARCON, have 'not at all' or 'a little' complaints of swallowing (77% vs 81%; $P=.37$) or speech (64 vs 63%, $P=.51$). Long-term function of speech and swallowing for patients presenting with T4 tumors was not impaired compared to T2-T3 tumors. The use of a feeding tube at 2 years from diagnosis was limited to 6% vs 4% of AR vs ARCON patients, respectively.

Conclusions: With ARCON, a high local control ($\pm 80\%$) and a significantly improved regional control rate are observed while maintaining excellent speech and swallowing function for the majority of patients, independent of T-stage. Long term dry mouth, sticky saliva and changes in taste and smell perception are limited to one quarter of patients and not different between both treatment arms.

PD-0050

Predictors and patterns of regional recurrence following lung SBRT: A report from the Elekta Lung Research Group

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Purpose/Objective: To determine the predictors and patterns of regional recurrence in patients treated with stereotactic body radiotherapy (SBRT) for primary lung cancers.

Materials and Methods: Patients with primary lung cancer treated with SBRT were identified from a multi-institutional (5) database of 965 cases. Patients with previous lung cancer or multiple lung tumors (231) were excluded leaving 734 analyzable patients. Details of patient factors, treatment specifics, toxicity and clinical outcomes were extracted from the database. All events were calculated from the end of radiotherapy. Estimates of local (LR), regional (RR), and distant recurrence (DR) were calculated using the competing risk method. Cause specific (CSS) and overall survival (OS) were calculated using the Kaplan-Meier method. Details of locations and number of simultaneous regional failures were categorized by lymph node (LN) anatomic level.

Results: The median follow-up time was 1.4 years (0.1-14.8 years). The median age was 76 years (42-94), 367(50%) were male, 644 (88%) tumors were peripheral per RTOG 0236 and 43 (6%) had mediastinal staging with EBUS/mediastinoscopy. Tumor location was right upper lobe (RUL) 235 (32%), right middle lobe (RML) 52 (7%), right lower lobe (RLL) 86 (12%), left upper lobe (LUL) 260 (35%), left lower lobe (LLL) 79 (11%) and missing 21 (3%). All patients had a staging PET scan. The median maximum tumor dimension was 2.3cm (0.7- 8.5cm). 476 had pathological proven cancer. The median RT dose was 54 Gy (18-64) and the median number of fractions was 3 (1-10). There were 64 RR. The 2 and 5 year recurrence rates were LR 5.6% and 8.3%, RR 9.0% and 13.4%, and DR 14.6% and 19.0% respectively. On univariable analysis (UVA) tumor dimension ($p=0.3$), tumor baseline SUV ($p=0.1$), histology ($p=0.3$), RT dose ($p=0.5$), tumor location ($p=0.8$) and gender ($p=0.6$) were not correlated with RR. On the biopsy proven cohort ($n=476$) the 2 and 5 year recurrence rates were LR 7.6% and 11.0%, RR 9.5% and 12.9%, and DR 17.9% and 21.5% respectively. On UVA tumor baseline SUV ($p=0.03$) was correlated with RR. There were 181 simultaneous sites of RR. 16 patients had single station RR in station 12R (1RUL), station 10R (2RUL, 2RLL), station 10L (1LLL), station 7 (2RUL, 2RLL, 1 LLL), station 4R (1RUL, 1RLL), station 2R (1RUL) and station 5 (1LLL). The pattern of LN failure was station 10 $n=23$ (13%), station 7 $n=70$ (39%), station 4 $n=25$ (14%), station 2 $n=10$ (6%) and other stations $n=53$ (29%). The most common RR levels were stations 4 & 7 for RUL and LUL, stations 4, 5, 7 & 10 for LLL tumors and stations 7&10 for RML and RLL tumors.

Conclusions: Baseline SUV is correlated with RR. Stations 10, 7 and 4 were most common stations for RR. These patterns of recurrence may guide nodal staging procedures prior to SBRT.

PD-0051

Patterns of re-treatment with radiotherapy within a well-defined catchment area

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Purpose/Objective: According to current evidence radiotherapy (RT) should be delivered to 50% of all cancer patients. In order to use this benchmark value to plan for RT capacity (i.e. linear accelerators and staff) in a given population it is necessary to account also for the proportion of repeat RT courses given after the first radiation treatment. The aim of the study was to determine the patterns of re-treatment for the cohort of patients who received their first RT course in 2009 in a RT department with a stable catchment area of 1.25 million inhabitants.

Materials and Methods: From the institutional RT database the following information was retrieved for all new RT patients in 2009: Start date of first treatment course and all subsequent courses, number of fractions and RT technique in each course, cancer diagnosis, age, and intention of the treatment (curative including SBRT and prophylactic RT or palliative). The number of patients receiving their first RT course in 2009 (*#first courses*) and the total number of re-irradiation courses delivered until now (*#re-irradiation courses*) were determined and the mean number of re-treatments was calculated as *#re-irradiation courses / #first courses*.

Results: The median age at first course was 65 y (range 5 mo-95 y). Total *#first courses* in 2009 were 2666 (1691 curative RT and 875 palliative RT). Breast cancer (46%), prostate cancer (14%) and head and neck cancer (9%) were the three most common diagnoses for patients treated with curative intent in their first course, whereas lung cancer (38%), prostate cancer (10%) and breast cancer (8%) were the most common diagnoses when the intent was palliative. Total *#re-irradiation courses* were 667 resulting in a mean number of re-treatments of 0.25 per patient (664/2666). The proportion of patients re-treated at least once was 18% (475/2666 patients), and three or more courses were given to 133 patients (5%). The maximum number of courses was 8 (one patient). The median time between the first and the second course was 553 and 144 days for patients treated initially with curative intent and palliative intent, respectively. The intent at the second treatment course was palliative for 78% of the patients and curative for 22% of the patients; 29 patients were treated with curative intent in both the first and second course. Breast cancer was the most common diagnosis in that group with 13 patients either treated for a second breast cancer or another cancer. In total 36 of the 2666 patients (1.3%) were later treated with RT for a new cancer diagnosis.

Conclusions: With a follow up period of 5 years the re-irradiation proportion was found to be 25% and the proportion of patients re-treated was 18%; these numbers are in good agreement with other published series and will be useful for the future planning of radiotherapy services.

PD-0052

A national audit for breast cancer radiotherapy in Norway

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Purpose/Objective: During 2009-2011, external peer review clinical audits for breast cancer radiotherapy was carried out at nine radiotherapy centres in Norway. The purpose was to assess compliance with the national radiotherapy guidelines regarding treatment planning for post-operative left sided breast cancer. All radiotherapy departments volunteered to take part in the audits. The audits were organized as a joint project between the Norwegian Breast Cancer Group (NBCG)

and the quality assurance group in radiotherapy (KVIST) at the Norwegian Radiation Protection Authority.

Materials and Methods: The audit topic was post-operative left sided breast cancer radiotherapy, focusing on indication and radiotherapy treatment planning. The audit standard was the national guidelines for breast cancer treatment (developed by NBCG). A set of audit criteria was developed to evaluate the clinical practice against the national guidelines. A total of 180 treatment files were audited by auditor groups composed of oncologists, medical physicists and RTTs. The audit findings were grouped to analyse the degree of guideline compliance for indication, treatment technique, delineation of treatment volumes and organs at risk, and dose related parameters.

Results: Over all, the auditors evaluated the indication, delineation, treatment planning qualitatively to be in accordance to the national guidelines without, or with minor deviance, in 87% of the cases. The treatment planning was in accordance with the guidelines for indication, treatment technique and lung delineation in 98% of the cases, with minor deviations in 2%. For delineation of the clinical target volume (CTV) and the heart, minor deviations were found in 44% of the cases, major deviations in 6%.

The dose distribution to the CTV was in accordance with the guidelines in 89% of cases, with minor deviations in 11%. A minimum dose to CTV (breast/breast wall) of at least 95% of prescribed dose ($D_{98\%} \geq 95\%$) was attained in 39%, whereas $D_{98\%} \geq 90\%$ was attained in 93% of the cases.

Conclusions: The audits showed that for a large majority of cases, the radiotherapy was planned in accordance to the guideline principles. To define and delineate the target volumes and the heart, and to obtain optimal dose distributions are challenging tasks, for which improvements are still desirable.

PD-0053

The cost of radiotherapy: a literature review

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Purpose/Objective: With the rapid growth of health expenditure, economic data have received increasing importance as source of information for decision makers. This is also true in technology-intensive sectors, such as radiotherapy, where initial capital investment is large and human resources important. To understand and quantify the evolution of radiotherapy costs it is necessary to be clear on which resources are included and how they have been combined to compute the cost.

Materials and Methods: A systematic literature review on cost computation studies in radiation therapy from 2002-2013 was conducted on Medline and Embase with the following search criteria: population: focus on external beam radiotherapy (EBRT); intervention: costing exercise using the departmental perspective and including at least personnel and equipment costs; outcome: cost of either radiotherapy treatment, activity or fraction(s), and/or cost of an entire radiotherapy department and/or cost of a specific cancer type including treatment with EBRT. To be included the article had to accurately describe the costing methodology. Computation studies based on charges and reimbursement were excluded.

Results: Of the 961 retrieved studies only 15 matched our search criteria, reasons for exclusion are as shown by the flowchart (fig 1). The most important reason for exclusion was the lack of formal cost computation (n=511) in the first